

WHAT IS CLAIMED IS:

1. A liquid crystal display device, comprising:
 - a liquid crystal layer that is held between a first substrate and a second substrate, in which each of dots contains a reflective display region for reflective display and a transmissive display region for transmissive display, the liquid crystal layer being composed of a nematic liquid crystal aligned substantially perpendicularly to the substrates and having a negative dielectric anisotropy;
 - a first retardation film having an optically negative uniaxiality, a second retardation film having an optically positive uniaxiality, and a first polarizer that are arranged in that order outside the first substrate; and
 - a third retardation film having an optically negative uniaxiality, a fourth retardation film having an optically positive uniaxiality, a second polarizer, and an illumination device that are arranged in that order outside the second substrate.
2. A liquid crystal display device, comprising:
 - a liquid crystal layer that is held between a first substrate and a second substrate, in which each of dots contains a reflective display region for reflective display and a transmissive display region for transmissive display, the liquid crystal layer being composed of a nematic liquid crystal aligned substantially perpendicularly to the substrates and having a negative dielectric anisotropy;
 - a first retardation film having an optically negative uniaxiality, a second retardation film having an optically positive uniaxiality, and a first polarizer that are arranged in that order outside the first substrate; and
 - a fourth retardation film having an optically positive uniaxiality, a second polarizer, and an illumination device that are arranged in that order outside the second substrate.
3. A liquid crystal display device, comprising:
 - a liquid crystal layer that is held between a first substrate and a second substrate, in which each of dots contains a reflective display region for reflective display and a transmissive display region for transmissive display, the liquid crystal layer being composed of a nematic liquid crystal aligned substantially perpendicularly to the substrates and having a negative dielectric anisotropy;
 - a second retardation film having an optically positive uniaxiality, and a first polarizer that are arranged in that order outside the first substrate; and

a third retardation film having an optically negative uniaxiality, a fourth retardation film having an optically positive uniaxiality, a second polarizer, and an illumination device that are arranged in that order outside the second substrate.

4. A liquid crystal display device according to claim 1, the thickness of the liquid crystal layer being smaller in the reflective display region than in the transmissive display region.

5. A liquid crystal display device according to claim 1, wherein, when n_{z1} and n_{z3} represent the refractive indices of the first retardation film and the third retardation film in a Z-axis direction serving as a thickness direction, n_{x1} and n_{x3} represent the refractive indices thereof in an X-axis direction serving as one direction in a plane perpendicular to the Z-axis direction, n_{y1} and n_{y3} represent the refractive indices thereof in a Y-axis direction perpendicular to the Z-axis and X-axis directions, and $d1$ and $d3$ represent a thicknesses thereof in the Z-axis direction, $n_{x1} \approx n_{y1} > n_{z1}$ and $n_{x3} \approx n_{y3} > n_{z3}$; and wherein a sum $W1$ of the retardation $(n_{x1} - n_{z1}) \times d1$ of the first retardation film and the retardation $(n_{x3} - n_{z3}) \times d3$ of the third retardation film has the following relationship with a retardation R_t of the liquid crystal layer in the transmissive display region:

$$0.5 \times R_t \leq W1 \leq 0.75 \times R_t.$$

6. A liquid crystal display device according to claim 1, wherein, when n_{z1} and n_{z3} represent refractive indices of the first retardation film and the third retardation film in a Z-axis direction serving as a thickness direction, n_{x1} and n_{x3} represent the refractive indices thereof in an X-axis direction serving as one direction in a plane perpendicular to the Z-axis, n_{y1} and n_{y3} represent the refractive indices thereof in a direction of a Y-axis perpendicular to the Z-axis and X-axis directions, and $d1$ and $d3$ represent a thicknesses thereof in the Z-axis direction, $n_{x1} \approx n_{y1} > n_{z1}$ and $n_{x3} \approx n_{y3} > n_{z3}$;

wherein, when n_{z2} and n_{z4} represent refractive indices of the second retardation film and the fourth retardation film in the Z-axis direction serving as the thickness direction, n_{x2} and n_{x4} represent a refractive indices thereof in the X-axis direction serving as one direction in a plane perpendicular to the Z-axis, n_{y2} and n_{y4} represent refractive indices thereof in the Y-axis direction perpendicular to the Z-axis and X-axis directions, and $d2$ and $d4$ represent the thicknesses thereof in the Z-axis direction, $n_{x2} > n_{y2} \approx n_{z2}$ and $n_{x4} > n_{y4} \approx n_{z4}$; and

wherein a sum $W1$ of the retardation $(n_{x1} - n_{z1}) \times d1$ of the first retardation film, the retardation $(n_{x3} - n_{z3}) \times d3$ of the third retardation film, the retardation

$((n_{x2}+n_{y2})/2-n_{z2}) \times d_2$ of the second retardation film in the XY plane and in the Z-axis direction, and the retardation $((n_{x4}+n_{y4})/2-n_{z4}) \times d_4$ of the fourth retardation film in the XY plane and in the Z-axis direction has the following relationship with a retardation R_t of the liquid crystal layer in the transmissive display region:

$$0.5 \times R_t \leq W_1 \leq 0.75 \times R_t.$$

7. A liquid crystal display device according to claim 2, wherein, when n_{z1} represents a refractive index of the first retardation film in Z-axis direction serving as a thickness direction, n_{x1} represents the refractive index thereof in an X-axis direction serving as one direction in a plane perpendicular to the Z-axis, n_{y1} represents the refractive index thereof in the Y-axis direction perpendicular to the Z-axis and X-axis directions, and d_1 represents a thickness thereof in the Z-axis direction, $n_{x1} \approx n_{y1} > n_{z1}$; and wherein the retardation $(n_{x1}-n_{z1}) \times d_1$ of the first retardation film has the following relationship with a retardation R_t of the liquid crystal layer in the transmissive display region:

$$0.5 \times R_t \leq (n_{x1}-n_{z1}) \times d_1 \leq 0.75 \times R_t.$$

8. A liquid crystal display device according to claim 2, wherein, when n_{z1} represents a refractive index of the first retardation film in a Z-axis direction serving as a thickness direction, n_{x1} represents the refractive index thereof in an X-axis direction serving as one direction in a plane perpendicular to the Z-axis, n_{y1} represents the refractive index thereof in the Y-axis direction perpendicular to the Z-axis and X-axis directions, and d_1 represents a thickness thereof in the Z-axis direction, $n_{x1} \approx n_{y1} > n_{z1}$;

wherein, when n_{z2} and n_{z4} represent refractive indices of the second retardation film and the fourth retardation film in the Z-axis direction serving as the thickness direction, n_{x2} and n_{x4} represent the refractive indices thereof in the X-axis direction serving as one direction in a plane perpendicular to the Z-axis direction, n_{y2} and n_{y4} represent the refractive indices thereof in the Y-axis direction perpendicular to the Z-axis and X-axis directions, and d_2 and d_4 represent the thicknesses thereof in the Z-axis direction, $n_{x2} > n_{y2} \approx n_{z2}$ and $n_{x4} > n_{y4} \approx n_{z4}$; and

wherein a sum W_2 of the retardation $(n_{x1}-n_{z1}) \times d_1$ of the first retardation film, the retardation $((n_{x2}+n_{y2})/2-n_{z2}) \times d_2$ of the second retardation film in the XY plane and in the Z-axis direction, and the retardation $((n_{x4}+n_{y4})/2-n_{z4}) \times d_4$ of the fourth retardation film in the XY plane and in the Z-axis direction has the following relationship with a retardation R_t of the liquid crystal layer in the transmissive display region:

$$0.5 \times R_t \leq W_2 \leq 0.75 \times R_t.$$

9. A liquid crystal display device according to claim 3, wherein, when n_{z3} represents a refractive index of the third retardation film in a Z-axis direction serving as the thickness direction, n_{x3} represents a refractive index thereof in an X-axis direction serving as one direction in a plane perpendicular to the Z-axis direction, n_{y3} represents the refractive index thereof in the Y-axis direction perpendicular to the Z-axis and X-axis directions, and d_3 represents the thickness thereof in the Z-axis direction, $n_{x3} \approx n_{y3} > n_{z3}$; and wherein retardation $(n_{x3}-n_{z3}) \times d_3$ of the third retardation film has the following relationship with a retardation R_t of the liquid crystal layer in the transmissive display region:

$$0.5 \times R_t \leq (n_{x3}-n_{z3}) \times d_3 \leq 0.75 \times R_t.$$

10. A liquid crystal display device according to claim 3, wherein, when n_{z3} represents the refractive index of the third retardation film in a Z-axis direction serving as a thickness direction, n_{x3} represents the refractive index thereof in an X-axis direction serving as one direction in a plane perpendicular to the Z-axis direction, n_{y3} represents a refractive index thereof in a Y-axis direction perpendicular to the Z-axis and X-axis directions, and d_3 represents a thickness thereof in the Z-axis direction, $n_{x3} \approx n_{y3} > n_{z3}$;

wherein, when n_{z2} and n_{z4} represent refractive indices of the second retardation film and the fourth retardation film in the Z-axis direction serving as the thickness direction, n_{x2} and n_{x4} represent refractive indices thereof in the X-axis direction serving as one direction in a plane perpendicular to the Z-axis direction, n_{y2} and n_{y4} represent refractive indices thereof in the Y-axis direction perpendicular to the Z-axis and X-axis directions, and d_2 and d_4 represent the thicknesses thereof in the Z-axis direction, $n_{x2} > n_{y2} \approx n_{z2}$ and $n_{x4} > n_{y4} \approx n_{z4}$; and

wherein a sum W_3 of the retardation $(n_{x1}-n_{z1}) \times d_1$ of the first retardation film, the retardation $(n_{x3}-n_{z3}) \times d_3$ of the third retardation film, the retardation $((n_{x2}+n_{y2})/2-n_{z2}) \times d_2$ of the second retardation film in the XY plane and in the Z-axis direction, and the retardation $((n_{x4}+n_{y4})/2-n_{z4}) \times d_4$ of the fourth retardation film in the XY plane and in the Z-axis direction has the following relationship with a retardation R_t of the liquid crystal layer in the transmissive display region:

$$0.5 \times R_t \leq W_3 \leq 0.75 \times R_t.$$

11. A liquid crystal display device according to claim 1, wherein, when n_{x2} and n_{x4} represent refractive indices of the second retardation film and the fourth retardation film in the X-axis direction serving as one direction in a plane perpendicular to the Z-axis direction serving as the thickness direction, n_{y2} and n_{y4} represent a refractive indices thereof

in the Y-axis direction perpendicular to the Z-axis and X-axis directions, and d_2 and d_4 represent thicknesses thereof in the Z-axis direction, the X-axis of the second retardation film and the X-axis of the fourth retardation film are orthogonal to each other, and the following condition is satisfied:

$$(n_{x2}-n_{y2}) \times d_2 = (n_{x4}-n_{y4}) \times d_4.$$

12. A liquid crystal display device according to claim 11, the second retardation film and the fourth retardation film satisfying the following condition:

$$100 \text{ nm} \leq (n_{x2}-n_{y2}) \times d_2 = (n_{x4}-n_{y4}) \times d_4 \leq 160 \text{ nm}.$$

13. A liquid crystal display device according to claim 1, the second retardation film being composed of two or more oriented films that convert linearly polarized light incident from the first polarizer into circularly polarized light in a broad band, and the fourth retardation film being composed of two or more oriented films that convert linearly polarized light incident from the second polarizer into circularly polarized light in a broad band.

14. A liquid crystal display device according to claim 1, the second retardation film being composed of two or more oriented films that convert linearly polarized light incident from the first polarizer into circularly polarized light in a broad band.

15. A liquid crystal display device according to claim 1, the fourth retardation film being composed of two or more oriented films that convert linearly polarized light incident from the second polarizer into circularly polarized light in a broad band.

16. A liquid crystal display device according to claim 1, the ratio $R(450)/R(590)$ of an in-plane retardation $R(450)$ for 450 nm and an in-plane retardation $R(590)$ for 590 nm being less than 1 in the second retardation film and the fourth retardation film.

17. A liquid crystal display device according to claim 1, the polarization axis of the first polarizer and the polarization axis of the second polarizer being orthogonal to each other.

18. A liquid crystal display device according to claim 1, the retardation $(n_{x1}-n_{z1}) \times d_1$ of the first retardation film being substantially equal to the retardation $(n_{x3}-n_{z3}) \times d_3$ of the third retardation film.

19. A liquid crystal display device according to claim 1, wherein, when n_{z1} represents the refractive index of the first retardation film in a Z-axis direction serving as a thickness direction, n_{x1} represents the refractive index thereof in an X-axis direction serving as one direction in a plane perpendicular to the Z-axis direction, n_{y1} represents a refractive index thereof in a Y-axis direction perpendicular to the Z-axis and X-axis directions, and d_1

represents a thickness thereof in the Z-axis direction, $n_{x1} \approx n_{y1} > n_{z1}$; and wherein the retardation $(n_{x1} - n_{z1}) \times d1$ of the first retardation film has the following relationship with a retardation R_r of the liquid crystal layer in the reflective display region:

$$0.5 \times R_r \leq (n_{x1} - n_{z1}) \times d1 \leq 0.75 \times R_r.$$

20. A liquid crystal display device according to claim 1, wherein, when n_{z1} represents a refractive index of the first retardation film in a Z-axis direction serving as a thickness direction, n_{x1} represents a refractive index thereof in an X-axis direction serving as one direction in a plane perpendicular to the Z-axis direction, n_{y1} represents a refractive index thereof in a Y-axis direction perpendicular to the Z-axis and X-axis directions, and $d1$ represents a thickness thereof in the Z-axis direction, $n_{x1} \approx n_{y1} > n_{z1}$;

wherein, when n_{z2} represents a refractive index of the second retardation film in the Z-axis direction serving as the thickness direction, n_{x2} represents the refractive index thereof in the X-axis direction serving as one direction in a plane perpendicular to the Z-axis direction, n_{y2} represents the refractive index thereof in the Y-axis direction perpendicular to the Z-axis and X-axis directions, and $d2$ represents the thickness thereof in the Z-axis direction, $n_{x2} > n_{y2} \approx n_{z2}$; and

wherein a sum $W4$ of the retardation $(n_{x1} - n_{z1}) \times d1$ of the first retardation film, and the retardation $((n_{x2} + n_{y2})/2 - n_{z2}) \times d2$ of the second retardation film in the XY plane and in the Z-axis direction has the following relationship with a retardation R_r of the liquid crystal layer in the reflective display region:

$$0.5 \times R_r \leq W4 \leq 0.75 \times R_r.$$

21. A liquid crystal display device according to claim 1, a reflective layer being provided in the reflective display region to reflect incident light.

22. A liquid crystal display device according to claim 21, the reflective layer being uneven to scatter and reflect incident light.

23. A liquid crystal display device according to claim 1, the X-axis directions of the second retardation film and the fourth retardation film being orthogonal to each other, and the X-axis directions of the second retardation film and the fourth retardation film form an angle of approximately 45° , respectively, with the polarization axis of the first polarizer and the polarization axis of the second polarizer.

24. A liquid crystal display device according to claim 1, an electrode having an aperture being provided on an inner surface, adjacent to the liquid crystal layer, of at least one of the first substrate and the second substrate so as to drive the liquid crystal.

25. A liquid crystal display device according to claim 1, projections being provided on an electrode disposed on an inner surface of at least one of the first substrate and the second substrate adjacent to the liquid crystal layer.

26. A liquid crystal display device according to claim 24, one dot containing at least two directors of the liquid crystal when the liquid crystal is driven by the electrode.

27. An electronic device comprising the liquid crystal display device according to claim 1.